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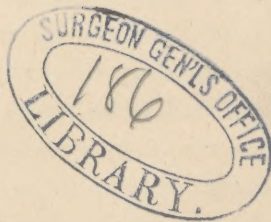
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A CONTRIBUTION TO THE SUBJECT OF
NERVE-STRETCHING

BY

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NEW YORK



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L. M. HAYS.

A CONTRIBUTION TO THE SUBJECT OF NERVE-STRETCHING.

IN

- I. LATERAL SCLEROSIS ; 2. PARALYSIS AGITANS ; 3. ATHETOSIS ,
4. CHRONIC TRANSVERSE MYELITIS ; 5. SCIATICA ; 6. REFLEX
EPILEPSY.

By WILLIAM J. MORTON, M.D.,

NEW YORK.

THE position of nerve-stretching as an operative procedure in medicine is not yet a fixed one. Its merits, its limits, its mode of action are yet undetermined. There are strong arguments for and against it. The operation suffers in credit, in certain instances, from incomplete performance,—the nerve now lifted from its position and laid back without being stretched at all, or again crushed on the edges of sharp instruments, as if the intention were to perform neurotomy instead of neurokinesis. The physiological action of the operation is not understood, though at this moment this aspect of the question is being studied in various lands. Pathological observations are few and conflicting. From a clinical standpoint alone is the operation well advanced.

In this state of affairs, the neurologist may well feel justified in pushing onward the inquiry to other diseases than those in which it has already been tried, and in attempting to determine by actual clinical experiment its range of usefulness.



Already established as a justifiable procedure in chronic sciatica and painful contractures, attention has been seriously directed during the last year to the treatment of locomotor ataxy by nerve-stretching. More than two dozen cases are on record in which remarkable benefit has been derived from stretching the sciatic nerve. And though the limited number of cases and the length of time that has elapsed since the operations do not yet warrant a final and general conclusion as to ultimate recovery, it must, nevertheless, be conceded that the operation in question has effected more than any previously known method of treatment. And we may note in passing that, in case the method should become established, it would be not a little curious that a disease which had been assailed by almost all known pharmaceutic remedies should at last yield, if even in a limited percentage of cases, to a simple surgical procedure.

Prompted by the success of this operation in locomotor ataxy I determined to make a trial of it in the analogous disease, lateral sclerosis, or spastic spinal paralysis. A preliminary report of the operation and of its immediately favorable results was made at the annual meeting of the American Neurological Society, June 16, 1881.¹ Sufficient time (eight months) has now elapsed to justify a detailed report of the case, and to demonstrate that the attempt was justified by the event. Several cases of nerve-stretching in spastic spinal paralysis have been reported since. In order that as many sides of the operation as is possible may be brought forward I will also report in the present contribution a trial of the operation in paralysis agitans, athetosis, and chronic transverse myelitis, three other diseases in which, as far as I know, nerve-stretching at the time of their respective operations had never been tried.

¹ JOURNAL OF NERVOUS AND MENTAL DISEASE, July, 1881, p. 618.

Additionally, I offer a case of nerve-stretching in a case of chronic, rebellious sciatica in which the cure was immediate and absolute, and therefore corroborative of previous favorable experience of the operation in this disease; and, lastly, a case of reflex epilepsy, in which disease previous favorable results would seem to justify a frequent repetition of the operation.

I will report these cases in the order in which they have been alluded to.

CASE I.—*Spastic spinal paralysis*: Paresis; spastic gait; muscular tension; exaggerated reflexes; absence of marked sensitive irritations; stretching, at different times, of both sciatic nerves with remarkable relief of all the symptoms.

April 30, 1881. Valentine Bennett, aged 50, a cooper, living in Williamsburg, came to the clinic for diseases of the nervous system at the Metropolitan Throat Hospital. As he entered the room he exhibited in a marked manner the peculiar spastic gait. The feet were shuffled along in a stiff and cramped manner, the back was bowed over from spastic condition of the anterior thigh muscles, and locomotion as a whole was painfully imperfect. He used a heavy cane for support. The patient complained of loss of power in his legs, of stiffness in all his movements, of a twitching of the arms and legs during the night, which he could not control. He gave in brief the following history: Present trouble began ten months ago, after exposure. He went to sleep in a cold cellar after being heated. At first he seems to have had pain which he thought was rheumatism. The joints, however, were not red, swollen, or hot. "All the bones in his body ached"; "his tongue was thick," the extremities cold; had also "tremendous stinging" and shooting pains along the track of the sciatic nerves. At the same time he had, as now, twitching and cramps in his legs and arms, and an interlocking of the heels in walking; his legs "were like stakes." Soon there supervened a feeling of numbness and tingling in the hands and feet, together with much loss of power. During the past four months the general numbness and tingling have ceased, but the loss of power has decidedly increased and settled almost entirely in the legs; they are heavy, stiff, and unmanageable. He walks as described. Sensory troubles have gradually abated. There

have never been bladder, defecation, or ocular symptoms. No history of syphilis attainable.

Condition when examined : Gait spastic, legs stiff, toes pushing along the ground, each step accompanied by a slight hopping movement or elevation at the heels ; his tendency is to topple forward ; carries a cane ; steps about six inches long ; the heels often interlock. Rising from a sitting posture is accomplished with much effort. On making the attempt the body is drawn forward spasmodically, the legs begin to shake, and on the point of reaching an upright position the patient is likely to fall forward.

All the leg muscles are in a spastic condition and the tendinous reflexes exaggerated. Any attempt at passive motion is met by involuntary muscular resistance, which must be slowly overcome, and such an attempt provokes at the same time violent shaking of the member. If, in the sitting posture, the leg is caused to rest upon the toes, violent trembling ensues. Dorsal flexion of the foot causes the same result. Or again, if, while lying on his face, passive flexion of the knee is attempted, violent muscular clonic contractions ensue to such an extent that the patient's whole body beats the table rhythmically. The adductors are equally rigid, and a reflex may be elicited from them. A firm push with the finger in the gluteus maximus excites clonic trembling of this muscle ; while, of course, the patellar reflexes are highly exaggerated. A slight numbness and tingling in the hands has lately appeared.

To these affirmative symptoms of lateral sclerosis must be added the negative. Sensation of all kinds is intact ; there exists neither anæsthesia nor paræsthesia. There is no pain excepting a slight soreness or sensitiveness of the soles of the feet. (Pain, numbness, and tingling occurred early, but ceased in a few months, with the exception of slight recent tingling in the hands.) No sphincter troubles of anus or bladder ; no ocular troubles ; no incoördination, or swaying on moving, or difficulty of walking in the dark, or with closed eyes ; no atrophy. Skin reflexes normal ; electro-muscular irritability normal.

In view then of the paresis, the muscular tension, twitchings, and the exaggerated reflexes on the one hand, and the absence of disturbances of sensibility on the other, nothing but a *post-mortem* could render more certain a diagnosis of primary lateral sclerosis, making the single reservation perhaps of a disseminated sclerosis attacking the lateral columns.

The patient was also carefully examined by Drs. Knapp and Fisher, clinical assistants, who concurred in the diagnosis.

Friday, June 16th. Assisted by Drs. Graeme M. Hammond, Allen, and Fisher. The patient was etherized. An incision made through the gluteus maximus, and the sciatic nerve of the *right* side lifted out of the sciatic notch on the forefinger, and vigorously stretched.

It required a very profound anæsthesia to overcome the involuntary shaking of the legs. The gluteus maximus was excessively thick, apparently normally hypertrophied by constant spasmodic action. The nerve presented nothing abnormal in its appearance. The finger was intentionally used to stretch with in order to avoid local laceration of nerve tissue. As far as can be judged by pulling on a spring balance for comparative measurement, a force of about forty pounds was exerted in pulling on the nerve. This was continued about five minutes, until a sense of something "giving" was experienced.

The wound was closed by wire sutures, dressed with carbolic oil, and the patient walked a number of blocks on his way home. No immediate effect in his walking could be observed. There was no numbness, and the patellar reflex was still as exaggerated as before.

June 22d. Patient reported as follows :

On June 11th, the day following the operation, there was no numbness and no sciatic pain, but the right leg twitched at times.

June 12th. Both legs "shook" on slight provocation, and there was twitching of the muscles of the right leg. This condition lasted for seven days, during which time he had not moved about much, owing to the soreness caused by the operation.

The wound healed quickly, and on the fourth day he had himself, with some family assistance, removed the wire sutures.

On this day, the 22d, he had walked over a mile to reach the clinic. The wound had healed by first intention. The patient's appearance had now greatly changed. His body was carried erect instead of bowed forward, and he walked with a long, free step without a cane. He says that he feels very much stronger in his legs, and that the stiffness and immobility have quite disappeared. He can get up at once from the chair and sit down again without, as before, putting his hands upon his knees and then falling into a tremble or shaking.

The soreness in the soles of the feet had disappeared, so that in place of the thick boots he had previously worn he now wore thin shoes.

The tingling which previously existed in the tips of fingers had also disappeared.

No passive movements of the legs, however suddenly executed, could now bring forth muscular spasm or the slightest trembling; the adductors had lost their rigidity; the exaggeration of tendinous reflexes was reduced almost to normal; the ankle clonus could not be evoked, nor the trembling while resting on the toe.

On June 23d, the patient was seen by Dr. William A. Hammond, who compared his present condition with his previous history, as given by himself, and considered the result as eminently satisfactory, as above reported.

July 1st. Up to the present time no relapse has occurred, and patient is walking about revisiting scenes and friends long unseen, on account of his infirmity. His last walk extended to five miles.

July 26th. Patient reports that his right leg "could not be better," but that the benefit at first experienced in his left leg from the operation was wearing away somewhat. On Saturday last after a long walk, and standing two hours on damp ground at a base-ball match, he went home, and soon experienced aching and soreness in the knee and calf, and numbness. Soon the leg began to twitch, and kept him awake all night by "jumping." These severe symptoms soon passed off, and the patient passed a comfortable summer. At his request I promised to operate on the left leg in the fall.

His family physician, Dr. J. D. Wade, of Brooklyn, writing under date of August 3, 1881, writes: "He (Bennett) has been suffering for about a year from some form of spinal difficulty, the exact nature of which I could not with my limited experience of these cases determine. I diagnosed it as a case of spinal softening, and treated it accordingly. The result was not very satisfactory, as he was gradually getting worse. Since the operation which you performed on him he has certainly been much better. It seems to me a novel method to cure spinal paralysis by stretching the sciatic nerve, but the result seems to verify your judgment in the matter. He is certainly very much improved by your treatment. Respectfully yours," etc., etc.

Oct. 11, 1881. The right leg, previously the worst, is now his best leg. Patient etherized, and *left* sciatic nerve at the junction of the middle with the lower third of the leg vigorously stretched. Using the finger hooked beneath the nerve, the leg was raised at least a dozen times from the table, and pulled from the centre and from the periphery. With the leg flexed at the knee the nerve lay in a loose sinuous loop upon the finger. With the leg extended this loop was greatly shortened and pressed upon the underlying finger.

Oct. 22d. Patient reports that on Wednesday, the day after the operation, he felt better. On Thursday night he had "jumping" in leg. On Friday this ceased. On Saturday, a slight trembling in the leg. Sunday, and ever since (six days), he has felt perfectly well. He now walks better even than after the first operation. There is a slight droop of the toes and liability to turn the ankle inward—due to temporary motor paralysis produced by the operation.

Nov. 1st. Tendon reflex, both legs, somewhat exaggerated. No trembling or clonus on passive motion; no cramps; no pains in soles of feet, or other pains. Walks naturally, but still with slight droop to left foot.

Dec. 17th. Patient satisfied that his improvement is great. Looking for work; walks miles—yesterday five miles. Before operations, he says he "crawled along" rather than walked. Tendon reflex alike in both legs and scarcely exaggerated. Trembling, none on getting up from sitting position or otherwise. Cramps, none. Soreness in soles of feet disappeared. Gait, walks as well as formerly, but "don't like to run." No muscular stiffness.

Jan. 23, 1882. Report as above. His only present trouble a slight weakness in the left knee and ankle.

It is not, of course, claimed that this case of lateral sclerosis is absolutely cured. But the result of the nerve-stretching has produced direct and appreciable benefits, such as no other treatment would seem to have been able to effect. The patient himself is now presented to the Society for verification of his present condition. It will be observed that the knee phenomenon is normal. Formerly repeated blows on the patellar tendon would maintain a continued extension of the leg. It is evident, also, that his spastic, crippled gait has changed to free, and long strides.

CASE 2.—*Paralysis agitans*. Sept. 26, 1881.

History.—S. F., planter, Louisiana, æt. 43; no neuropathic family history. Patient a healthy child, and now a strong, hearty-looking man. Present trouble began in the spring of 1875. At that time, while in perfect health apparently, noticed a "drawing" sensation in the left shoulder; can only describe this as a "feel-

ing" in the left arm and shoulder. In the summer the left leg began to drag, and the heel of the left boot wore away. No loss of consciousness, headache, loss of sensation, difficulty of speech, urinary or defecation troubles. This left leg never got any better, and within a few months the left arm began to shake, but not severely; he could control it. Two years later, 1877, about the same symptoms appeared on the right side, and in the same order: first in the arm, then in the leg; then the arm began to shake. Since 1877 the shaking or trembling has increased in severity, and is now involuntary. About 1879 the whole body, except the head, began to be comparatively rigid, and difficulty in walking increased. This spring, 1881, all his symptoms have become more pronounced, and he cannot now dress himself, cut his meat, feed himself, etc., etc. The head has become fixed and bent forward, and the trembling more severe and general. Walking is difficult and clumsy. He can assign no cause for his trouble. Has had no fright or other emotional trouble. As remotely interesting, it may be mentioned that two years previous to 1875 he accidentally shot a pistol ball into the flexor side of the *right* index finger, and shattered the bone extensively. The wound healed kindly.

Present condition.—Rhythmical, continuous trembling of both arms, severest in hands. Brief intermissions occur while lying down; the slightest attempt at purposed movements excites a violent shaking of the arms, which increases up to a maximum. Emotional disturbances have the same effect. The head never trembles; eyelids tremble when closed; tongue trembles slightly when projected; lips not tremulous; utterance slow and with effort; deglutition easy; in a close room has a feeling of oppression at the epigastrium, or, as he expresses it, feels "choked up." Trembling ceases during sleep. No nystagmus, amblyopia, diplopia, or vertigo. Propulsion and retropulsion marked, especially when tired. Is very "nervous," excitable, irritable, and easily moved to tears; much discouraged about himself. Gets greatly fatigued. Requires to have his position changed frequently. Walks but little, and that with assistance. The left leg is more unmanageable than the right. The rigid and "soldered together" look of the patient's body, as described by Charcot, exists to a marked degree. The head is rigidly fixed and projected forward; the trunk flexed on the thighs; the legs flexed at the knees; the arms flexed at the elbows. As he rises with great effort and with assistance from a chair he shoots forward a number of steps, and then stands or walks in the clumsy manner peculiar to these patients.

Passive flexion and extension are both difficult, and must be executed slowly on account of involuntary muscular resistance. No cramps, but the third toe of the right foot remained very persistently flexed. Patient's hands are the characteristic "writing-hands" of Charcot. Muscular power well retained but slowly



FIG. 1.—Paralysis agitans, "writing-hand," from photograph.

brought into action. Speech slow and not understood, except by those familiar with it. Dynamometer, right hand, 45; left hand, 55. Tendon reflex normal, but response slow. No alterations in general sensibility; temperature normal; sphincters normal; sexual functions normal. [Has a child fifteen months old.] Electro-muscular contractility normal.

Treatment.—Patient had already experienced every treatment familiar to me in medicine. At one time he had returned to his home from New York with five hundred $\frac{1}{4}$ grain pills of nitrate of silver. At another he had taken chloride of gold for months; again he had been treated by hyoscyamia, by the mouth and subcutaneously; he had taken various bromides, zinc, strychnia, phosphorus, etc., and he had tried galvanism, and he continued to grow steadily worse. I felt justified, therefore, in treating him by static electricity.

I will not here give in detail his treatment by static electrization, since it would be a deviation from the purpose of this paper, but I will sum up its effects in a few words.

After various trials to the spine of sparks 8 inches long and correspondingly powerful, of direct shocks from Leyden jars to his spine and limbs, none of which benefited him in the least, I at length found that the general administration of small sparks (two inches) to every rigid muscle produced immediate results and cumulative benefit. After sparks had been directed during about fifteen minutes to the rigid groups of muscles at the knees, thighs, and elbows, the patient would gradually straighten up, with the head free and more easily rotated, the trunk erect, and

the legs straight; his speech would become clearer and the trembling less; the flexion even of the third toe, commonly present, would disappear. The results thus produced remained often as long as twelve hours, and since no other treatment for paralysis agitans had effected this much, either for physician or patient, the case was satisfactory to both for about one month.

But now occurred a relapse with great mental irritability and muscular rigidity and tremor. Under these disheartening circumstances—how disheartening every physician and every patient who has exhausted every resource may well judge of for himself—I proposed to the patient a trial of the operation of stretching the sciatic nerve, explaining to him fully the *pros* and *cons* of the plan. And I here report the case, because any operation of nerve-stretching in the present state of the history of this operation is worthy of report, because of the peculiar condition in which I found the nerve, and because of the decided benefit derived from the operation by the patient. In such a case it is not a question of cure; this latter seems to be almost unknown in the present stage of medicine.

Oct. 18, 1881. Operation. Assisted by Dr. Bowditch Morton and Dr. Sabal, of Jacksonville, Florida, the patient was etherized and an incision two inches long made at the junction of the lower with the middle third of the thigh. At this point the nerve is easily found; upon dividing the subcutaneous cellular tissue and the aponeurosis, the interspace between the biceps and the semi-membranosus is clearly defined. On pushing aside the biceps the great trunk of the nerve is clearly seen. I would suggest to the non-surgical operator to work mainly with the director after dividing the subcutaneous cellular tissue, and to be especially careful not to cut through the fascia of the muscles, for in so doing he may be led much astray. The operation at this point is a very simple one,—much simpler than at the sacro-ischiatic notch, as performed in Case 1.

The nerve, when lifted out of its bed on the hooked finger, presented an appearance and created a sensation to the touch different from that of any sciatic nerve of a living person I have ever held in my hand. In external appearance it was large and round and of a dirty yellowish-brown color. Ordinarily the nerve is not as large as this one was, and it is rather flattened and of a pearly-white color (locomotor ataxia, lateral sclerosis, athetosis, and epilepsy), or else tumefied, reddened, and surrounded by tortuous veins (sciatica). To the touch the nerve was hard, firm, stiff, and

unyielding, and gave when stretched a gritty or creaking sensation. We may therefore conclude definitely, from the macroscopic appearances, that the sciatic nerve was in a condition of sclerosis. In fact, the stretching of the nerve was proceeded with carefully, owing to its peculiarly brittle feeling. These characteristics were verified by the gentlemen assisting me. I need not say that the temptation was great to secure a small fragment for microscopic examination, but the welfare of my patient forbade the attempt to do so. The nerve, however, bore a considerable weight in stretching,—as far as I could judge, of about forty pounds; the leg was lifted from the table several times, suspended by the nerve-loop; it was also pulled from the periphery and from the centre; each time that the spinal end was pulled upon the patient was partially aroused from what a second previously, from the breathing, and lack of skin and conjunctival sensation, seemed to be a profound anæsthesia. When pulling on the nerve there is experienced a peculiar feeling of giving or yielding, due probably to the yielding of normal connective-tissue adhesions.

The extent of the stretching may be indicated by this observation. With the leg extended the nerve could be raised a full inch above the level of the skin; with the leg flexed the nerve could be raised full two inches. It was remarkable to observe, in this as in other cases, how much free play in longitudinal movement there is normally in the sciatic nerve. This is easily demonstrated by resting the nerve on the finger and then causing the leg to be alternately flexed and extended; with each extension the subjacent finger is drawn down against the leg; with each flexion the nerve may be lifted up clear of the skin. Tremor ceased during etherization. Ether was borne remarkably well.

The nerve, now serpentine, was laid back in its bed and four silver-wire sutures and carbolic-oil dressing applied.

On recovering from the effects of the ether patient had very imperfect use of his leg. The toes drooped, the foot swung inward, and he could not advance or draw back the leg; sensation was nearly abolished.

Oct. 19th (day following operation). Patient in bed; general exacerbation of all the symptoms of his disease noted on the 15th still continues. Patient now, as then, restless, mentally irritable, and requiring to have his position frequently changed. Both hands tremble steadily, but may be stilled by being firmly held by his wife. Left leg (one operated on) has very little voluntary power. No marked diminution of cutaneous sensation.

Oct. 20th. Tremor continues ; power returning rapidly to leg. The curious fact was now noted that leg operated on now responds normally and *quickly* to volition, while the right leg exhibits the same slowness of response noted for both legs previously. Patient walks about a little and thinks his left leg has now become his best leg.

Oct. 23d. Wound suppurated ; washed out with carbolized water.

Oct. 30th. Left leg, though more easily moved in the sense that it obeys the will quicker, exhibits, nevertheless, certain localized and, so to speak, accidental paralyses, for the toe droops a little and the heel cannot be easily raised from the floor while the patient is in a sitting position.

Nov. 2d. Patient walks into and out of my office unaided.

Nov. 5th. Wound healed. Walking greatly improved ; walks unaided and without cane. Slight drag to left leg ; also slight numbness and subjective sense of swelling of the lower leg.

Various unimportant records are here omitted.

Nov. 20th. Steady improvement ; delayed, however, by febrile attacks consequent upon a closed fistula ani.

The general rigidity of the legs, arms, trunk, and neck has almost entirely disappeared, so that patient now walks more freely and more erect. Passive flexion of arms, before resistant, now easy. Tremor less, *i. e.*, less severe, and longer periods of rest. Still some motor paralysis in left lower leg, gastrocnemii principally.

Mental irritability less.

Faradization to the paralyzed muscles caused daily improvement in them.

Patient now returned home.

On January 2, 1882, his wife writes :

"Mr. F. walks a good deal better ; he walks every morning to the store, not a very great distance, but further than he was able to walk since the operation."

And again, Feb. 1 : "His" (the patient's) "walking is a good deal better than before the operation."

In conclusion, I wish to repeat that this case is not reported with any idea of claiming a cure of paralysis agitans. It is merely a contribution to its treatment—an effort made to alleviate symptoms.

Viewed in this light, it offers various satisfactory points.

It is of course impossible to make an absolutely clear demarcation between the effects produced by static electricity and by nerve-stretching; but it is a fair inference that his general improvement was due to the localized and to the reflex effects of the direct application of the electricity to each muscle and to the peripheral nerve distribution; and that the special, isolated, and local improvement in the left leg, which, from being the worse became the better of the two, must be attributed to stretching of the sciatic nerve of that leg. In this connection it has already been noted that the stretching evidently brought the leg in better communication with the volitional centre, as seen in the superior command at once gained over its purposed movements.

The usual remissions in chronic nerve complaints must also be taken into account.

Whether the operation would be worth repeating in cases of this disease is a question that each must decide for himself.

For my own part, I would not, on the limited amount of evidence that I have presented, offer an opinion to any one else.

CASE 3.—*Athetosis*; beginning in childhood; right side.

Since the discovery and naming of this disease by Dr. Hammond in 1869, observers have not failed to note cases of this peculiar disease, lying midway, in its characteristics of rhythmical, peristaltic, and yet forcible movements, between the quick and jerky movements of chorea and the fixed rigidity and contracture common to hemiplegia. The case which I now present came to Dr. Hammond's clinic in the summer of 1881, and after various futile attempts at treatment was referred to my own clinic, where I had opportunities of treating with static electricity. Under this treat-

ment marked improvement as is so often the result, occurred during the first few weeks of treatment, but a point beyond which no amendment was discernible was then reached.

Attracted by the misfortunes of the young man who, in spite of his infirmity, is intelligent, industrious, and ambitious to make his living, I presented to him the alternative between a motionless hand and arm or one constantly squirming about in fantastic attitudes.

Having already exhausted innumerable remedies and forms of treatment, he readily accepted the prospect, if only for a limited period, of a still hand, and agreed to have his nerves stretched.

But before detailing the operation and its results, I will refer to the fact that, in relation to this disease of athetosis, this particular patient has a certain historical interest. His case was the first one recorded in Great Britain, and the first after Dr. Hammond's original cases. It is reported in full in the *Journal of Mental Science*, July, 1873,¹ by Dr. W. T. Gairdner, Professor of the Practice of Medicine in the University of Glasgow; was under treatment in the Royal Infirmary, and was exhibited at the sectional meeting of the Medico-Psychological Association in Glasgow, June, 10, 1873.¹ Referring to this case² Dr. Gairdner says: "The subject of it—a boy aged fourteen years, who had been affected with the disease since he was three years old—left Glasgow suddenly along with the family, and is known, I believe, to have gone to America; but I have been unable to trace them, otherwise I should have directed, if possible, Dr. Hammond's special attention to the case."

On Oct, 14, 1881, I took the following notes of the case :

At the age of three it was noticed that the right leg gave way,

¹ Transactions of the Medico-Psychological Association, Glasgow. *Journal of Mental Science*, July, 1873, p. 311.

² *Lancet*, June 9, 1877. A case of Hammond Athetosis. By W. T. Gairdner, M.D., etc., etc.

causing him to fall. Had no convulsions or loss of consciousness. Until eleven years of age was very lame, then walked better.

Three months after the right leg was first affected, the right hand began to show peculiar movements. It would unintentionally close on objects and hold them fast. Then the hand and fingers began "to twist and work," particularly when he attempted purposed movements. This hand, as far as he recollects, has never been better or worse up to this day. Has been subject also for years to a severe darting pain in the region of the lower ribs of the right side. Reports also, just previous to any affection of the leg and arm whatever, a severe inflammatory attack of the right eye, which lasted two months.

Present condition.—The most obvious feature of his case is the peculiar movements found only in athetosis. The right



FIG. 2.—Athetosis.

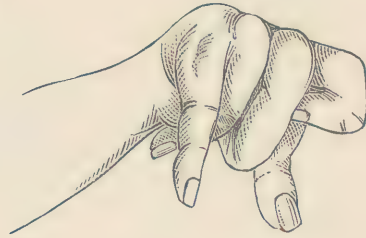


FIG. 3.—Athetosis.

hand continuously throughout his waking hours performs a slow and measured series of motions of the most varied character, and utterly unpredictable, each change of position occupying about five seconds in its accomplishment. It is a curious fact, and one that I have not seen noted of the athetosis movements, that they were in nearly every instance compound, *i. e.*, a flexion in one part of the hand combined with an extension in another part, or *vice versa*. For instance, I noted a series as they occurred, and noted them on the moment. These were always combined and not single muscular movements. For instance, six movements, occupying about thirty seconds, were as follows :

1. Little finger and wrist, extreme extension ; rest of fingers, extreme flexion.
2. Index finger, extreme extension ; wrist and remaining fingers, flexion.
3. Pronation of arm, extension of wrist, flexion of fingers, and rigid flexion and adduction of thumb.
4. Ring finger, extension ; rest of fingers, flexion.
5. Extreme wrist extension and finger flexion.
6. Extreme wrist flexion and finger extension ; and so on in every conceivable kaleidoscopic pattern that the varied action of the numerous muscles of the hand can give rise to, but in no instance were there movements of single muscles as in chorea.

It was particularly difficult to catch these movements in the photographic camera, even with very sensitive plates. I reproduce wood-cuts of several that I succeeded in taking, since they depict more faithfully than words can the compound contortions of the patient's hand.



FIG. 4.—Athetosis.

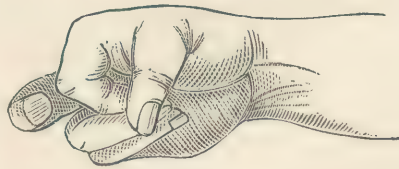


FIG. 5.—Athetosis.

Beyond these movements there is little else to note here.

The right leg is smaller and softer than its fellow. Toes of right foot subject to tonic spasm. The right arm also somewhat smaller than the left, and the flesh softer and somewhat flabby, due to the fact possibly that the patient carries his arm in his overcoat pocket to conceal its movements, and hence exercises it but little. Hand lacks little in strength. Dynamometer, right hand, 38 (imperfectly grasped) ; left hand, 40. Temperature, right hand, 98.5° ; left hand, 98.2 ; sensation, normal.

It requires considerable force to alter any given position. Emotion and volition increase the frequency, continuousness, and force of the movements. When taken by surprise he has a difficulty in speaking. He knows the word, but cannot utter it. Reflex exaggerated.

Treatment.—Eight-inch sparks to spine and affected parts.

Oct. 17th. Motions are quieter, and patient is certain that the hand does not close up as tightly as formerly. Yesterday, after treatment, the hand remained passive for an hour and a half—a thing that has not occurred for years.

Nov. 2d. In spite of encouragement at first derived from the use of static electricity, the patient's improvement is at a stand-



FIG. 6.—Athetosis.

still. The sparks resolve, so to speak, for a time, the tetanoid condition of the muscles. On the contrary, the static induced current and the ordinary Faradaic currents increase this condition to a marked degree.

Nov. 16th. Operation. Assisted by Dr. Bowditch Morton and by Dr. Knapp. The patient was etherized in the operating-room of the Metropolitan Throat Hospital. The athetosis movements ceased entirely during anæsthesia.

Cut down on to the median nerve at the junction of the lower and middle thirds of the arm, and stretched the nerve vigorously with the index finger crooked like a hook. Using the nerve as a loop, the extended arm was lifted again and again from the table

and pulled strongly downward, in order to pull upon the spinal cord. Like the sciatic, a larger loop is afforded during flexion of the member than during extension. The nerve was very strongly restrained from longitudinal movements by its fascia. Replaced nerve, sutured wound with silver wire, using carbolized-oil dressing.

The ulnar nerve was then stretched in the same manner. Both nerves are easily found.

After patient had entirely recovered from his anæsthesia there were no movements whatever in the hand or forearm. Patient walked home.

Nov. 18th. Stitches removed from ulnar wound; both wounds uniting by first intention; forearm quite numb; held in continuous flexion at a right angle to the upper arm by a tonic contraction of the biceps. No movements in the fingers; they are in a position of semi-flexion; has a slight clonic movement of thumb. Tested by æsthesiometer the real amount of anæsthesia is not great.

Nov. 19th. Stitches now removed from both wounds and both united by first intention. No movements.

Nov. 20th. Severe neuralgic pain from palm of hand to tips of fingers. Biceps still in tonic spasm.

Nov. 21st. Pain continues. No movements.

Nov. 23d. Still has pain, but it is diminishing. No involuntary movements, but passive manipulation of the hand creates what appears to be simple mechanical displacement of the fingers quite as if they were attached to tendons fixed at a given point.



FIG. 7.—Athetosis. Hand at rest, due to nerve-stretching.

Nov. 25th. Pain ceased; hand quiet. Says that it is the first time in his memory that the hand has ever remained at rest. Referred to Dr. Hammond for corroborative examination.

Nov. 30th. Report like last entry. The accompanying cut illustrates the present position of the hand.

Jan. 25, 1882. Neuralgic pains long since disappeared.

The continuous and compound movements are now totally abolished. But there is at times still a very slight twitch of the thumb. The position of the fingers is in an easy and natural flexion. Some numbness of the hand persists. Patient says that it is a great deal less trouble to him than formerly, and that he prefers it a thousand times in its present condition.

CASE 4.—*Chronic transverse myelitis*. Reported from Dr. Hammond's clinic. C. C., æt. 64. In 1864 first noticed a tingling sensation in his two feet; this gradually extended up the legs. During the last two years has had twitching in the legs, great loss of sensation, sense of constriction around the waist, much wasting of the muscles, trouble in retaining his urine, constipation, and great difficulty of locomotion. Present condition as above, and additionally exaggerated reflexes, especially patellar tendon reflex, sensation of walking on soft ground, ataxic gait, coldness and bluish-red color of the legs, and atrophy of the muscles. Never had pain in his legs. Electric irritability of nerve and muscles neither quantitatively nor qualitatively altered.

Aug. 4, 1881. The right sciatic nerve had already been stretched by Dr. Osborn with excellent results.

Sept., 1881. The patient was brought before the class at the University Medical School, and at Dr. Hammond's request I stretched the left sciatic nerve. The operation was performed without an anæsthetic, since the patient did not feel the cutting of the knife or the pulling of his nerve.

The following very curious and favorable results followed the two operations. These results we must merely summarize from our notes. Cutaneous sensation returned immediately upon the stretching. The legs, five minutes previously insensible to the cut of a knife, were now sensitive to the slightest prick of a pin. During the operation the patient located the pain of the incision and handling of the nerve to the region of the anus. After stretching he located painful sensations correctly.

An immediate sequence of the return of sensation was the return of the knowledge of the relation of the soles of his feet to the ground, hence the power of locomotion seemed, as it were, miraculously restored to him.

One month later patient was still much improved.

Jan. 27, 1882. I examine the patient and find that very little permanent benefit remains. The anæsthesia is not as complete as before, but the other symptoms are nearly as prominent as previously.

The case suggests two reflections. In the first place the operation did no harm; unmistakable, though temporary, benefit was derived.

In the second place, it is not unlikely that a portion of the benefit indubitably derived in locomotor ataxy, above and beyond the relief of the fulgurating pains, is due to a return of cutaneous sensation, perhaps also muscular sense, and hence, consequently, increased power of locomotion.

CASE 5.—*Idiopathic sciatica*. Nerve-stretching; immediate and permanent cure.

Oct. 1, 1881. Anthony Dimmick, æt. 33, applied to clinic for nervous diseases at the Metropolitan Throat Hospital for relief of his pain. History in brief:

Eight months ago first noticed one morning a sharp pain in the left hip. Was obliged to go to bed on account of his suffering. Then noticed swelling along the calf of the leg and the foot; the two outer toes were numb. Numbness and swelling continued during two weeks. Left his bed, but pain was constant, and worst at night. The leg was held stiff and the body bent much forward. Walking increased the pain, which finally became so crippling and so excruciating that he went to Roosevelt Hospital for treatment and was admitted.

Through the courtesy of Dr. G. D. Parmly, junior assistant at this hospital, I am able to give a *résumé* of the records of the case while in the hospital.

Anthony Dimmick, æt. 33, September, 1881, admitted.

Previous history.—Father died of rheumatism (?). Phthisis denied. Has had chills and fever. Never had rheumatism. No recollection of scarlatina. Is a moderate drinker, and has been for some time. Specific denied. Does not appear to have had any secondary symptoms.

About six months ago, after exposure, had a sharp pain behind left trochanter, and generally experienced a *stitch* in that region when getting up. At times, this would travel down the leg to the foot, and the two outer toes felt numb. Left foot and calf swelled a good deal for three weeks, soon after beginning of sickness. Could not sleep for pain. Not sick in any other way. Pains in buttock and leg lasted nearly three months. Then pains left (three months ago) and patient worked hard at laboring work for

about three months, until three weeks ago, when the pain behind trochanter returned, but not so severe as before. There has been no swelling of leg, and pain does not run down the leg as before. Is not kept awake at night by pain as was during previous illness.

Present condition.—Well nourished. Feels pretty strong. Face ruddy, lips red. Pupils normal, equal, competent. Conjunctivæ slightly injected. Tongue indented over dorsum. Bowels rather confined. Appetite good and pulse strong. Good deal of pain in region of left sciatic. Walks bent over. P. 72, R. 20, T. 98.8°, P. M. Urine alk., 1,023, alb. 20 per cent. (Probably no renal elements found by microscope, or they would have been noticed in history.)

History of treatment.—Actual cautery along course of sciatic nerve and confinement to bed.

Sept. 10th. Has been up for past two days. Stands straighter, but still somewhat bent over. Walks with much less trouble. (Pain on pressure still present between trochanter and tuber ischii.)

Sept. 12th. Pain does not trouble him much (when quiet). Still a good deal bent over (and pains him when he walks, especially if he makes an unexpected motion which brings stress upon parts surrounding left trochanter or tub. ischii).

Patient eloped to-day from the hospital, and his discharge bears *improved* after it.

Dr. Parmly adds: "Why the patient eloped we do not know, but I suspect the cautery had again been proposed. It certainly helped him very much."

After leaving the hospital, pain and consequent bending over of the body returned, and patient, as stated, came under my care. The history has been already sufficiently detailed. I may only add to it that the tract of the nerve, especially in the thigh, was extremely sensitive to pressure.

Oct. 4th. Static electricity applied, and pain at once relieved for that day and night. Patient walks well. Static electricity was now applied thrice weekly for two weeks, with the same experience of absolutely relieving the pain for about twenty-four hours, and then a relapse. The patient on the whole walked better and had less pain, but since his progress was comparatively slow, I determined, with his consent, to stretch the nerve, and did so.

Operation—Oct. 22, 1881.

Before operating, sciatic nerve examined by palpation. Slight pressure elicited cries of pain from the patient. Etherization by

Dr. George B. Hope. Incision at junction of middle and lower thirds of the left and affected leg. The nerve, at once laid bare, was red, tumefied, and surrounded directly on its surface by small irregularly winding veins. It was stretched, using the finger as a hook, for five minutes, and with force sufficient to lift the leg from the table. It was also pulled from the centre vigorously. Here, as in other cases, were noted the inextensibility of the nerve itself, the yielding sensation due probably to the yielding of the connective-tissue envelopes, and the fact that the nerve trunk was pulled strongly down into the wound by extension of the leg. No signs of tortuous veins remained after stretching. Wire sutures, carbolic dressing.

Recalling the extreme sensitiveness of the nerve to pressure before etherizing, Dr. Hope and myself agreed not to refer to his sensations of pain while he recovered from his ether, but to wait for his own first expressions. To our gratification he soon walked about freely and informed us that he had no pain whatever. Patient walked home.

Oct. 23d. No pain.

Oct. 29th. No return of pain. Suppuration in wound.

Nov. 17th. Now 26 days after the operation, no return of pain or soreness. Track of sciatic nerve may be pressed upon freely. Patient walks as well as ever in his life and has gone to work.

Nov. 19th. Lifting heavy weights brought on some soreness in nerve.

Nov. 22d. Stopped worked ; soreness disappeared.

Jan. 10, 1882. Various favorable records are omitted. Says he feels splendidly. There is to-day, however, a single small area of tenderness and pain, about as large as the end of the finger, over the outer head of the gastrocnemius. This causes no trouble in walking.

Cauterized this area with Pacquelin's thermo-cautery.

Jan. 23d. Three months after operation still remains free from pain and is cured.

It will be noticed that the cure was almost absolutely complete from the moment of stretching the nerve. The only detraction from this statement is the brief soreness arising from lifting heavy weights, lasting only a few days, and the very small area of soreness, equally

brief and quickly curable, occurring in a small twig of the nerve in the calf of the leg.

CASE 6.—*Reflex epilepsy, right side.* Terence Duffy, æt. 40. Feb. 5, 1880, patient came to the clinic for diseases of the nerves, at the University Medical School, service of Dr. W. A. Hammond.

History.—During the last ten years has been subject to numerous daily attacks of spasm. These attacks, numbering from fifteen to twenty daily, occur mostly while he is in bed, between three and six o'clock in the morning; but they also occur frequently and unexpectedly in the daytime, while in the street, or while about any occupation whatsoever. Occurring in the standing position, the trunk is drawn over to the right side against the right leg, or, as he says, he "is doubled up like shutting a jack-knife." There is no loss of consciousness. An aura always exists. The main peculiarity of the attack is that it may be induced, usually at will by patient, physician, or accidentally by a bystander, by touching various points of what appears to, be a true epileptic zone of Brown-Séquard. The touch of the barber to the right side of the neck, or of one of his children on his shoulder, often brings on an attack. Urination sometimes brings on an attack (irritation neck of bladder?).

No neuropathic history; no knowledge of injury to any part of the body; used to drink to excess, and thinks this caused his disease; has specific history; children healthy; never falls, loses his senses, or bites his tongue. Irregular eating and drinking increase number of attacks. Mind good, though thinks his memory is slightly impaired; no headaches and no vertigo.

Aura.—The aura always starts at some point higher or lower in a line drawn almost straight up from the right inguinal region to the anterior region of the axilla, and thence spreading out broadly along the side of the neck. When first observed this aura began by a feeling of "twitching and jumping" over the right spermatic cord, ascending thence to the head. Of late it has been very exactly defined to the line of the anterior thoracic nerve. Sometimes it starts over the right lower ribs, again from the right axilla.

The Attack.—This is the same whether occurring spontaneously with the aura described, or provoked by pressure or tickling along its track. It is essentially a tonic spasm of the trunk muscles of the right side, continuing for about half a minute. There

may be noted : first, pallor, then spasm, and, in a few seconds, extreme congestion of the face. He attributes contortion of the facial muscles to pain. The right pupil dilates, the left does not. Pulse varies from 88 to 96. When an attack occurs he clasps his side with the right hand, in order to support himself ; then when the spasm is over, straightens up, with a feeling of great relief. He notices that he cannot see well for some time after, especially if he attempts to read.

I omit any further quotations from Duffy's record up to a recent date, and will simply summarize these records by saying that he was treated assiduously with bromide of sodium during eighteen months. By this treatment the attacks were diminished in severity and in number. At times his reports were encouraging, at times otherwise. Finally, in Dec. and Jan. of 1881, he was treated with glonoin. This, like the bromides, at first gave favorable results, but soon seemed to lose its power. The patient was finally referred to my clinic, where I treated him unavailingly with static electricity. He was now having from five to ten attacks daily, and the disease was assuming a graver aspect, since for the first time he had an attack with loss of consciousness, biting of the tongue, etc., etc.

In despair I proposed nerve-stretching. Any prospect of relief however remote was hailed gladly by the patient, who, I must say, has remarkable perseverance in search of cure, and I accordingly operated. I report the case for what it is worth, without pretending to draw conclusions at this early date. Something surely may be learned from failures to cure, should this turn out to be one.

Jan. 24, 1882. Operation. Present : Drs. Clinton Wagner, H. H. Howland, Whiting, and Bowditch Morton. Patient etherized, and small incision made in the lower part of the axilla. After dividing the skin and subcutaneous cellular tissue, the aponeurosis was divided on a director, and the axillary vein and artery

exposed. The median, ulnar, and internal cutaneous nerves were separately extracted and hooked over the end of a silver catheter ; then the finger was passed beneath them and they were vigorously stretched and pulled from the centre, with a view of stretching the entire brachial plexus and cervical cord. The wound was then closed with wire sutures and dressed with carbolic oil.

Jan. 25th. Slept well. This morning had two attacks only,—an improvement upon the five to ten he usually has had ; attacks very slight. Motion. Dynamometer, right hand, 0 ; left hand, 65. Sensation : all the fingers and thumb are numb both on palmar and dorsal aspects ; numbness extends up the hand and arm ; no pain.

Jan. 26th, 27th, 28th. No attacks.

Jan. 29th. Three attacks. Stitches removed ; wound healed by first intention.

Jan. 30th. Three attacks.

Jan. 31st. Two attacks, very slight.

Feb. 2d. Three.

Feb. 3d. Four.

The class of cases that I have reported is not one in which we expect cures. In the case of sciatica I think it is safe to say that no other known measure could have effected relief as quick, and at the same time as permanent. In the other cases great benefit was derived, and I do not forget to add that no harm was done.

From a surgical standpoint the operation on the sciatic in the middle third of the leg is a simple one ; the brachial plexus and various nerves of the arm require more care ; while the facial nerve, whose relations I am now examining with the view of stretching it for facial spasm in a few days, would seem to present numerous difficulties. Suppuration frequently occurs when the sciatic is stretched, due probably to trophic disturbance. Having found the nerve the question arises how shall it be stretched, *i. e.*, what shall it be stretched with, and with how much force ? Operators vary greatly in these respects. Some are content to lift the nerve rather gently and lay it back in its bed (Billroth,

Nussbaum, Hammond); others pull on it with considerable force (Fenger and Lee, Callender); others, in addition to pulling on the nerve by aid of the hooked finger, seize it with thumb and index finger, and pull in both directions, in the longitudinal direction of the nerve; while others, again, like Verneuil and Baum, bruise or crush it either with forceps or against the sharp edges of a director. Various implements variously protected with rubber have been used.

It is to be regretted that there is not yet more unanimity of opinion regarding the amount of force to use, and that the actual amount that has been used in the cases thus far recorded has not been measured. This I admit as a shortcoming in my own cases. I propose in the next instance to measure the force applied in lifting the nerve from its bed, by using the finger, where this is possible, as a hook beneath the nerve, and causing an assistant to place the large hook of a spring balance between the index and middle fingers, in such a manner as to raise both hand and nerve together. A French surgeon has even gone so far as to devise an instrument resembling a balance, one arm of which, covered with gutta-percha, raises the nerve, while the other records the force employed. My only objection to this would be the employing of any thing besides the operator's finger against the nerve, for I do not believe it is advisable to crush the axis-cylinders.

The nerves are very inextensible, therefore it is necessary to stretch long, say three to five minutes; they are very strong, and therefore considerable force must be employed. An analysis of successful cases shows that the nerves had been thoroughly and vigorously pulled upon. But, obviously, in drawing conclusions as to the amount of force used we must also know the instrument with which the nerve was stretched. Strong stretching with the finger

would probably produce less rupture of the axis-cylinders than moderate stretching over the edge of a director.

According to the experiments of Trombetta on the cadaver, the brachial plexus withstood a tension of from 48 to 81 lbs. before breaking or tearing off at the posterior roots; the crural withstood about 83 lbs.; while the sciatic on an average sustained, before breaking, a traction of 184 lbs. Experiments on the cadaver also show that the main strain after the resistance of the natural adhesions to surrounding parts is overcome, is expended upon the posterior roots. In this may lie an explanation of the observation made, that sensation is interfered with to a greater extent than motion.

Is the spinal cord stretched? Harless and Huber, Valentin and Conrad are cited by Chauvel¹ as saying it is not. But functional disturbances created on the other side of the body, in certain reported experiments, would seem to indicate that the spinal cord is in reality pulled downward. According to Gilette the medulla oblongata in a cadaver was felt to move when the sciatic was pulled upon. This observation, if correct, certainly renders the conclusion definite, that we may hope to influence the cord by the operation, and it is on this supposition that I have operated in a number of cases. In case the cord is stretched, we have still another reason why it is difficult to prescribe the remedial limits of the operation, since its effects are not confined to the territory innervated by the stretched nerve, but extend widely to other nerve territories. It is beyond the province of this contribution to the subject of nerve-stretching to enter into a discussion of the anatomical, physiological, or pathological lesions produced by the operations, or to speculate upon the *modus operandi* of the benefits derived, the cures effected, or the failures reported.

¹ *Archives Générales de Médecine*, June, 1881.

Our knowledge upon these points is still too conflicting to enable one, either from experience or reading, to draw any definite conclusions. In the one case we stretch a nerve to interrupt the propagation of the centrifugal or motor nerve current, as in spasm; in another, to interrupt the centripetal or sensory current, as in reflex epilepsy and tetanus; again, we hope to accomplish one or both objects, and, additionally, alter the nutrition of the nerve cord, as in spastic spinal paralysis, locomotor ataxy, or sciatica.

From my own experience I can simply draw these conclusions:

1st. That moderate stretching of the nerve produces merely a temporary motor paralysis, easily recovered from, and a very considerable paralysis of sensation, likewise easily recovered from.

2d. That severe stretching produces a marked motor paralysis of long continuance (months), and a tolerably complete paralysis of sensation, much more quickly recovered from than is the motor paralysis. Cases of spasm should therefore be stretched vigorously.

3d. That profound cutaneous anæsthesia may be removed for several months and perhaps permanently; Case 4.

4th. I have been unable to observe, as has been claimed, that sensibility is relatively lost to a greater extent and more persistently than motion, either by moderate or severe stretching. In my cases motor paralysis has been more persistent than sensory.

According to Chauvel, Laborde, Brown-Séquard, and Quinquand have been led to believe, by certain physiological researches, that the sensory or centripetal current is arrested in the stretched nerve, while the centrifugal or motor current is not greatly interfered with.

This, while true of the normal nerve, does not seem to be the common experience in disease.

The sensation of pricking and tingling, and the occurrence of neuralgia should also be noted as occurring in the above cases. Spasmodic movements did not occur.

Macroscopic appearance of nerves.—In cases 1, 3, 6,—spastic spinal paralysis, athetosis, and reflex epilepsy,—nothing abnormal was noted.

In case 4,—chronic transverse myelitis,—the sciatic nerve was thin and flat like a ribbon, white, and evidently much atrophied. In case 5,—sciatica,—the tumefaction and reddening of the nerve have been commented upon, and also the tortuous veins.

In case 2,—paralysis agitans,—appears to me to be the most interesting observation regarding gross appearances.

Charcot concludes a review of the pathological anatomy of this disease by saying that “the special lesion of paralysis agitans remains to be discovered.” The morbid histological changes found in the records of *post-mortems* thus far made, are too various or too unimportant to allow us to rely upon any one of them, or any grouping of them, for explanation of the symptomatology of the disease. The only observation, singularly enough, that I can find of a condition of induration of a peripheral nerve, is the very first *post-mortem* observation ever made upon the disease, and this by Parkinson himself, who, in his essay on shaking palsy, published in 1817, was the first to give any regular description of it. In this first case the pons was augmented in volume and indurated. The medulla and upper cervical cord were also indurated, and, additionally (cited from Charcot), “the nerves of the tongue and those of the arms were *like tendons*.”

This latter description of the gross appearances and the feeling of a peripheral nerve exactly corresponds to what I observed in the sciatic.

It is yet premature to say in what particular disease the

operation will be of greatest value, or what further valuable therapeutic indications or systems of treatment may be gained from the increasing data of an operation, undoubtedly yet crude, but nevertheless more full of promise than any recent measure for the treatment of diseases of the nervous system. It is true the last bulletins from Germany are unfavorable to the operation in locomotor ataxy. A congress of German naturalists has discussed the operation, and decided adversely to it. The Medical Society of Berlin seems also to have pronounced against it in locomotor ataxy, affirming that "the symptoms soon came on more severely than before."

It is not my purpose here either to favor or defend, but merely to contribute; but I confess that from all I have thus far seen I am strongly in favor of the operation.

It may be that operative or surgical nerve-stretching may be abandoned, but the clinical experience already accumulated will probably lead to a fixed system of local treatment of nerves in many chronic affections, hitherto untreated in this manner and considered incurable by any remedies.

The direct treatment of nerves by means other than the internal use of remedies has always been a fascinating field of inquiry. Pressure, pounding, hammering, mechanical vibrations, massage, electrical currents—interrupted and constant,—and the penetrating spark of statical electricity, are all strivings to get at the nerve itself and produce an effect. The surgical operation solved the problem of directness of attack; we are satisfied now that the nerves may be safely exposed, handled, stretched, and no harm result to the patient; and equally satisfied that in some diseases cures are effected by this means, in others benefit derived. The present is the stage of modification and systematizing. Already a most important substitute for the surgical operation is proposed, in the form of subcutaneous nerve-stretching. The possibility of stretching the nerve by certain

forced positions of the limbs occurred to me at once on observing the rigidity of the nerve in its line of length, and the decided traction that could be exerted upon it by certain changes in the position of the members. This method of subcutaneous stretching can be most easily applied to the sciatic nerve by flexion of the thigh on the trunk with knee flexed, and then completing a full extension of the leg. Severe pain in the sciatic nerve can be induced by this measure, but with careful manipulation and education of the patient this is soon avoided. The brachial plexus may be stretched in the same manner. To this treatment, which I have now been pursuing for some time at my clinic and in private practice, I add massage and kneading of the nerve trunks themselves, and the penetration of spinal cord by powerful sparks from an electric machine. All this, it will be seen, is in the direct line with the idea of mechanical treatment of the nerve substance itself, and in direct line with the subject of nerve-stretching, since I believe that finally we shall substitute, in the chronic systemic diseases of the spinal cord, these or some similar methods of mechanical treatment, for the present surgical operation. More than a year ago I claimed for the penetrating and disruptive spark of the electric machine an effect upon the spinal cord and nerves that seemed to me to be simply due to molecular change, or alteration of nutrition as a result of mechanical violence. This, it seems to me, is the best explanation of the effects of nerve-stretching, in whatever way it be effected.

But whether surgical nerve-stretching survives or not, it has called attention to what may be gained by local and direct interference, as contrasted with treatment by drugs; and I trust that clinical results will continue to accumulate, until a fixed opinion of the real place of the operation in medicine shall have been rigidly and scientifically determined.

THE JOURNAL OF NERVOUS AND MENTAL DISEASE

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